

Remarks

This application contains claims 1-132, the status of which is as follows:

(a) Claims 42, 53-54, 63, 65, 70, and 74 are as originally filed.

(b) Claims 2-3, 5-8, 10, 12-20, 23, 25, 30, 34, 36, 38-40, 43, 45-48, 50, 52, 55-60, 78-80, 119-126, and 128-131 were previously presented.

(c) Claims 1, 22, 24, 28-29, 35, 41, 62, 64, 68-69, and 75 have been currently amended.

(d) Claims 4, 9, 37, 44, 49, 76-77, and 81-118 were previously canceled without prejudice, and claims 11, 21, 26-27, 31-33, 51, 61, 66-67, 71-73, and 127 have been currently canceled without prejudice.

(e) Claim 132 is new.

No new matter has been added.

Applicants thank Examiner Bockelman for the courtesy of a personal interview with Applicants' representative, Daniel Goldstein (Reg. No. 44,127), held in the USPTO on August 18, 2009. At the interview, the Applicants' representative and the Examiner discussed possible amendments to independent claims 1 and 41, as previously presented, in light of US Patents 6,341,236 to Osorio et al. and 6,571,121 to Schroeppel et al. The Examiner agreed that the amendments to the claims made hereby appear to overcome the art as applied in the outstanding Office Action, subject to an additional reading of Osorio and Schroeppel.

Rejections under 35 U.S.C. 112

Claims 1-3, 5-8, 10-36, 38-43, 45-48, 50-75, 78-80, and 119-131 were rejected under 35 U.S.C. 112, second paragraph, as being

indefinite. The Examiner argued that independent claims 1 and 41 "are ambiguous as to whether current is configured to lower heart rate variability below a baseline heart rate variability of the subject which **corresponds** to the heart rate variability when the current is not applied or whether the current drives the heart rate variability below a baseline when the current is turned off" (p. 2, emphasis in the original). Applicants have amended claims 1 and 41 to include clarifying language suggested by this rejection.

In addition, the Examiner argued that the apparatus recited in claim 1 does not necessarily lower heart rate variability, and may in certain circumstances simply provide stimulating current. Applicants have amended claim 1 to recite the configuration parameter previously recited in claim 27 (and intervening claims 21 and 26), namely that "the control unit is configured to initiate the applying of each burst after a delay of about 30 to about 200 milliseconds following an R-wave of the cardiac signal."

Furthermore, the Examiner argued that in method claim 41, "it is unclear if the 'results' are an intended result or an actual result since applicant does not claim that the subject heart rate variability is altered, only that the current is configured to alter the heart rate variability." Applicants have amended claim 41 to clarify that the results are actual results, and to emphasize that the method includes identifying a subject as being appropriate for heart rate variability reduction and treating the subject by reducing the heart rate variability.

Applicants thus respectfully submit that all of the pending claims are allowable under 35 U.S.C. 112, second paragraph.

Rejections under 35 U.S.C. 102(b) and/or 103(a)

Osorio et al.

Claims 1-3, 5-8, 10-36, 38-43, 46-48, 50-51, 53-55, 57-66, 69-75, 78, 120-124, and 126-131 were rejected under 35 U.S.C. 102(b) as

anticipated by, or, in the alternative, under 35 U.S.C. 103(a) as obvious over US Patent 6,341,236 to Osorio et al. Claims 119 and 125 were rejected under 35 U.S.C. 103(a) as being unpatentable over Osorio in view of US Patent 5,578,061 to Stroetman et al. Claims 45, 52, 56, 67-68, and 79-80 were rejected under 35 U.S.C. 103(a) as being unpatentable over Osorio in view of US Patent 6,571,121 to Schroepel et al.

The Examiner wrote that he "believes that the Osorio et al. device is capable of reducing heart rate variability in a patient that has a pre-existing high heart rate variable condition baseline condition if it were applied to such a person." The Examiner also argued that Fig. 7 of Osorio "seems to show vagal stimulation that has reduced heart rate variability during VNS as opposed to prior and after the stimulation."

While disagreeing with these rejections, in order to expedite the issuance of a patent, Applicants have amended independent claim 1 and 41 as discussed hereinbelow.

Independent method claim 41

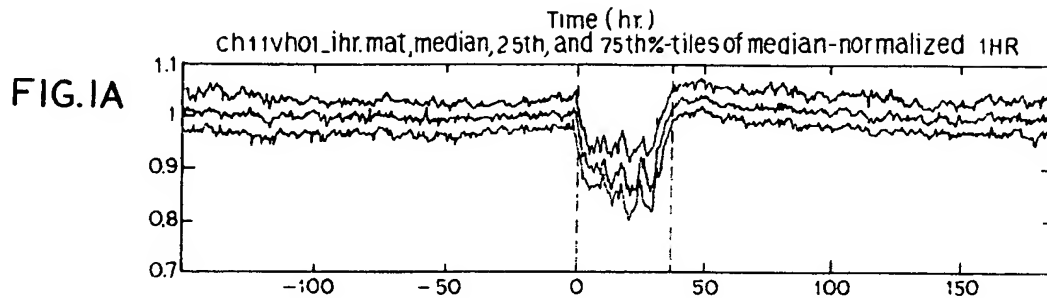
As discussed during the interview, Applicants have amended independent method claim 41 to further recite "identifying a subject as being appropriate for reduction of heart rate variability. . . ." and "in response to the identifying, treating a condition of the subject by reducing the heart rate variability. . . ." Support for these amendments is provided in the application as filed *inter alia* beginning at p. 70, line 22.

Applicants respectfully submit that although Osorio's device might be capable of being configured to practice the novel techniques recited in claim 41 as amended, there is no teaching or suggestion in Osorio to do so. Osorio teaches monitoring and modulating heart rate variability only to minimize undesired changes in heart rate variability caused by vagal stimulation for treating epilepsy. Osorio states, "It is an object of the present invention

to minimize or eliminate the effects on the heart caused by the electrical stimulation of the vagus nerve 60" (col. 8, lines 32-34; emphasis added). Thus, Osorio neither teaches nor suggests identifying a subject as being appropriate for reduction of heart rate variability below its baseline rate and treating a condition by reducing the heart rate variability. Indeed, doing so would run counter to Osorio's stated object of minimizing the effect of his stimulation on the heart.

Applicants now turn to Fig. 7, which was discussed during the interview. Although for the reasons described herein claim 41 is considered patentable over Osorio, and therefore the following discussion is not considered necessary to demonstrate the patentability of claim 41, Applicants nevertheless respectfully submit that Fig. 7 does not include sufficient data to draw any conclusion regarding the effect of Osorio's vagal stimulation on heart rate variability. The stimulation period is too short, and the non-stimulation period is much too short, to provide meaningful data for the type of analysis proposed by the Examiner. Even the data that are shown do not support the Examiner's assertion that heart rate variability decreased during the stimulation period. The Examiner's calculation fails to take into consideration, *inter alia*, the last four points during the stimulation period (between g5 and 37.7 seconds; see col. 10, lines 45-47), two of which have values of about 80 BMP. Inclusion of these points would substantially increase the heart rate variability according to the Examiner's calculation technique.

Furthermore, conventional vagal stimulation increases heart rate variability. Osorio himself clearly illustrates this vagal-stimulation-induced increase in heart rate variability in Fig. 1A (vagal stimulation was applied beginning at time 0):



Osorio himself understood that his vagal stimulation generally increases heart rate variability: "Generally, stimulation of the vagus nerve 60 increases heart rate variability (standard deviation) at higher IHR values. It is therefore desirable to provide a technique for vagus nerve stimulation that minimizes or has no effect on the normal operation of the heart as measured by the standard deviation of the IHR as a function of the IHR" (col. 8, line 65 - col. 9, line 4).

Applicants thus submit that independent claim 41, as amended, is patentable over Osorio. As discussed above, during the interview with Applicants' representative, the Examiner agreed that the amendments to claim 41 appear to distinguish over Osorio, subject to an additional reading of Osorio.

Apparatus claims 1 and 27

While not necessarily agreeing with the rejection of independent claim 1, Applicants have amended claim 1 to recite the configuration parameter previously recited in claim 27 (and intervening claims 21 and 26), namely that "the control unit is configured to initiate the applying of each burst after a delay of about 30 to about 200 milliseconds following an R-wave of the cardiac signal."

In rejecting dependent apparatus claim 27, the Examiner argued, "The device [of Osorio] can be started at any time and would be capable of being synchronized or unsynchronized and could be started anywhere in the cardiac cycle" (p. 7 of the office action).

Applicants respectfully submit that although Osorio's device might be capable of being configured to implement the novel delay parameter recited in claim 27, there is no teaching or suggestion in Osorio to do so. Applicants submit that this recited delay from the detected R-wave is not simply an engineering optimization, but instead may account for the surprising, unconventional heart-rate-variability-lowering effect of vagal stimulation recited in claim 1. Applicants note that a delay from the R-wave falling within the recited range is the first parameter given in the description of the dog experiment described on pp. 108-109 of the specification with reference to Fig. 6.

Applicants thus submit that independent claim 1, as amended, is patentable over Osorio. As discussed above, during the interview with Applicants' representative, the Examiner agreed that the amendments to claim 1 appear to distinguish over Osorio, subject to an additional reading of Osorio.

Schroeppel et al.

Claims 1-3, 5-8, 10-36, 38-43, 45-48, 50-75, 78-80, 86, and 119-131 were rejected under 35 U.S.C. 103(a) as obvious over US Patent 6,571,121 to Schroepel et al. in view of US Patent 6,341,236 to Osorio et al.

Independent method claim 41

The Examiner wrote, "The Examiner includes Osorio et al for its explicit teaching of currents reducing heart rate variability. To have made the reduction of heart rate variability the goal of the Schroepel treatments and used the Osorio et al techniques would have been obvious" (pp. 8-9 of the office action).

Schroeppel only briefly mentions using vagal stimulation for treating a patient having abnormal heart rate variability: "The next higher level 156 calls for a form of neural stimulation to stimulate vagal activity of the patient" (col. 9, lines 39-41). There is no

teaching or suggestion in Schroepfel that such vagal stimulation would be used to decrease heart rate variability. In fact, Schroepfel elsewhere expresses the conventional understanding that vagal activity is associated with increased heart rate variability: "As another factor, a smaller amount of variability exists at higher heart rates. For example, a person with a heart rate of 100 bpm typically will have more sympathetic nerve activity inhibiting vagal action. In this situation, the heart rate variability of the patient expectedly is extremely low" (col. 13, lines 37-42). In other words, Schroepfel believes that inhibition of vagal tone decreases heart rate variability.

Furthermore, as discussed above, Osorio does not teach treating a condition by applying vagal stimulation to reduce heart rate variability below a baseline level of the subject in the absence of such stimulation, as recited in claim 41. Even if Schroepfel were to suggest treating a heart condition by applying vagal stimulation to reduce heart rate variability, which he does not, Osorio provides no guidance that would enable one of ordinary skill in the art to configure vagal stimulation to deliberately reduce heart rate variability.

Applicants thus submit that claim 41, as amended, is patentable over Schroepfel in view of Osorio. As discussed above, during the interview with Applicants' Representative, the Examiner agreed that claim 41 as currently amended appears to distinguish over Schroepfel, subject to an additional reading of Schroepfel.

Apparatus claims 1 and 27

The Examiner gave no specific reasons for the rejection of claim 27 over Schroepfel et al. in view of Osorio et al. Applicants thus submit that claim 1, as amended to include the features previously recited in claim 27, is allowable at least for the reasons given above regarding the patentability of claim 1 over Osorio.

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In light of the suggested patentability of independent claims 1 and 41, all of the other pending claims are also in condition for allowance, being of narrower scope than the independent claims from which they directly or indirectly depend.

New claim

Independent claim 132 is new, and recites a method including features similar to those recited in apparatus claim 1, as amended hereby. Applicants respectfully submit that claim 132 is allowable for the same reasons discussed above regarding claim 1, as amended hereby.

The Applicant believes the amendments and remarks presented hereinabove to be fully responsive to all of the grounds of rejection raised by the Examiner. In view of these amendments and remarks, the Applicant respectfully submits that all of the claims in the present application are now in order for allowance. Notice to this effect is respectfully requested.